Priming the Pump: Cleaner Approaches to Airport Ground Transportation

Wednesday, May 8, 2019
2:00-3:30 PM ET
Purpose


Learning Objectives

At the end of this webinar, you will be able to:

• Describe the feasibility of using alternative fuels in airport fleet vehicles
• Understand how to analyze the environmental emissions tradeoffs between different types of alternative fuels
• Discuss how to develop clean vehicle policies for private GT operators at airports
• Describe the various approaches and strategies used to encourage GT providers to operate more environmentally friendly
ACRP Webinar
Priming the Pump — Cleaner Approaches to Airport Ground Transportation
May 8, 2019
Abubaker Azam (Abu) has over thirty years of Aviation Management experience. In his role as Sr. Manager Operation - Airport Services at San Francisco International Airport (SFO) he is responsible for all commercial ground transportation activities and administers SFO’s Clean Vehicle Policy.
Five Ways to Get Involved!

1. Join the ACRP IdeaHub community

2. Volunteer for a project panel

3. Prepare a research proposal

4. Answer an ACRP survey

5. Apply the research results

Visit us online: www.trb.org/ACRP
Today’s Speakers

Geoffrey Morrison and Cian Fields,
The Cadmus Group, Inc.

Presenting ACRP Synthesis 85

*Alternative Fuels in Airport Fleets*

and

Alexander Kolpakov and Austin Sipiora,
University of South Florida

Tami McCrossen-Orr,
Los Angeles World Airports

Presenting ACRP Synthesis 89

*Clean Vehicles, Fuels, and Practices for Airport Private Ground Transportation Providers*
Alternative Fuels in Airport Fleets

Geoff Morrison, Principal Investigator
Cian Fields, Project Manager
Geoff Morrison, PhD, PMP
Principal Investigator

Senior Associate, Cadmus
Former US Department of Energy Postdoctoral Fellow
Former US Naval Officer (SWO-N)

Cian Fields
Project Manager

Senior Analyst, Cadmus
Project Manager for ACRP 02-82: Roadmap to Achieve Zero Emission Airport
ACRP Synthesis 85 Oversight Panel

Abu Azam, SFO
Danielle Bower, PHL
Dorothy Harris, DEN
Prem Lobo, Missouri S&T University
Melinda McCoy, SNA
Sandy Webb, Environmental Consulting Group, Inc.
Stephanie Meyn, SEA
Christine Gerencher, TRB Liaison
Patrick Magnotta, FAA Liaison
Gail Staba, ACRP Senior Program Officer
ACRP Synthesis 85: Alternative Fuels in Airport Fleets

Synthesis of airport experience with alternative fuels in airport-owned and airport-operated vehicles:
- Barriers
- Training
- Benefits
- Costs
- Infrastructure

Fuel types considered:
- Biodiesel
- Renewable diesel
- Compressed natural gas
- Liquefied natural gas
- Liquefied petroleum gas
- Hydrogen
- Electricity

Vehicles considered:
- Shuttles
- Emergency response and security
- Facility and maintenance vehicles
Example of a “Typical” Airport Fleet

Takeaways: Wide mix of vehicles; Airport fleet does not include ground support equipment (GSE), commuter vehicles, passenger vehicles, or aircraft
Methodology

Literature review
Online survey of 33 airports
Telephone interviews with 16 airports and fuel providers

Takeaway: Research team collected both qualitative and quantitative data
Takeaways: CNG and electricity are the two most often used alternative fuels; many airports use multiple alternative fuels.
# Literature Review

**Takeaways:** Every fuel has advantages and disadvantages. Airports need to tailor their alt fuel program to their specific goals.

<table>
<thead>
<tr>
<th>Transit Bus</th>
<th>Fuel Cost</th>
<th>Vehicle Cost</th>
<th>Fuel Availability</th>
<th>Vehicle Availability</th>
<th>GHG Emissions (kg/mi)</th>
<th>Air Quality (Tailpipe Emissions Only)</th>
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</table>


**Key:**

- Worse than reference
- Slightly worse than reference
- Similar to reference
- Slightly improved over reference
- Improved over reference

*Colors should not be compared between vehicle types or columns.*
### Takeaways:
Literature review also highlights vehicle availability and publicly-available tools for airports.

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<th>Vehicle Category</th>
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<th>Compressed Natural Gas</th>
<th>Renewable Natural Gas</th>
<th>Liquefied Natural Gas</th>
<th>Liquefied Petroleum Gas</th>
<th>Hydrogen</th>
<th>Battery electric</th>
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<td>Van</td>
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<td>X</td>
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<tr>
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</tbody>
</table>

**Key:**
- ✓ Widely available
- ~ Limited availability/demonstration only
- X No availability

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Description</th>
<th>Emissions Tools</th>
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<tbody>
<tr>
<td>Greenhouse Gas Regulated Emissions and Energy Use in Transportation Model (GREET)</td>
<td>This model enables users to easily perform life-cycle analysis simulations of alternative transportation fuels and vehicle technologies.</td>
<td></td>
</tr>
<tr>
<td>Aviation Environmental Design Tool (AEDT)</td>
<td>AEDT is a software system that dynamically models aircraft performance in space and time to simulate fuel burn, emissions, and noise.</td>
<td></td>
</tr>
<tr>
<td>MOtor Vehicle Emission Simulator (MOVES)</td>
<td>This emission modeling system estimates emissions for mobile sources at the national, county, and project levels for criteria air pollutants, GHGs, and air toxins.</td>
<td></td>
</tr>
<tr>
<td>EMission FACTor (EMFAC)</td>
<td>This emissions model is developed and used by the California Air Resources Board to assess emissions from on-road vehicles including cars, trucks, and buses in California.</td>
<td></td>
</tr>
<tr>
<td>How Clean Is Your Electric Vehicle?</td>
<td>This calculator allows users to compare emissions of plug-in hybrid electric and battery electric vehicles to gasoline-only vehicles, by ZIP code.</td>
<td></td>
</tr>
<tr>
<td>Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool</td>
<td>This tool helps users examine both the environmental and economic costs and benefits of alternative fuel and advanced vehicles.</td>
<td></td>
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</table>
Impact of Organizational Structure on Alt Fuel Adoption

<table>
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<th>Centralization</th>
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<td>High</td>
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<td>Low</td>
<td>High</td>
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<tr>
<td>Low</td>
<td>Low</td>
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</tbody>
</table>

Source: Nesbitt and Sperling (2001)

**Takeaways:** Hierarchic structures (high formalization/centralization) most conducive structure for alt fuel fleet conversion
Takeaways: Airports relied on a mix of federal and state finance mechanisms, primarily grants and P3s.
Facility and Maintenance Vehicles

Takeaway: Pickups and sedans most often CNG; forklifts most often electric; other vehicles most often biodiesel.
Emergency and Security Vehicles

Takeaway: Lower use of alt fuels in emergency and security vehicles.
Buses, Shuttlebuses, and Vans

Takeaway: Buses had highest use of alternative fuels of any specific vehicle type.
How Airports Can Use this Research

- Understand current state of industry
  - 71 percent of airports used CNG vehicles
  - 64 percent of airports used electric vehicles
  - 83 percent of airports constructed new stations/infrastructure when introducing a new alternative fuel.
- Find which vehicle-fuel combinations are most popular
- Compare emissions/costs across fuels using Synthesis 85’s tables
- Identify other airports using given fuel
- Understand funding sources and tools for alt fuel transition
- Anticipate barriers:
  - Buy America constraints
  - Not every fuel-vehicle combination available
  - Fuel supply constraints (e.g., renewable diesel, renewable natural gas)
Buses and shuttle buses make good candidates for beginning an alternative fuels program because:

1. High levels of pollution near pedestrians
2. Highly predictable duty cycles, simplifying refueling events
3. Publicly visible, enabling airports to present an environmentally friendly image
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Clean Vehicles, Fuels, and Practices for Airport Private Ground Transportation Providers

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Austin Marie Sipiora

Center for Urban Transportation Research
Alexander Kolpakov
Principal Investigator

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- 15+ years experience in transportation research
- Experience in transportation policy analysis, alternative fuels evaluation, airport infrastructure valuation

Austin Marie Sipiora
Research Assistant

- Research Assistant, Center for Urban Transportation Research (CUTR), USF
- Experience in planning and policy analysis, alternative fuels research, survey and outreach
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Dorothy Harris, Denver International Airport – Revenue Management
Tamara McCrossen-Orr, Los Angeles World Airports
Patrick W. Magnotta, FAA Liaison
Harold Morgan, Taxicab, Limousine & Paratransit Association Liaison
Ray A. Mundy, University of Missouri- St. Louis Liaison
Christine Gerencher, TRB Liaison
Gail R. Staba, ACRP Senior Program Officer
Synthesis of public-use airport experience with implementing clean vehicle policies for private ground transportation operators

- Summarizes clean vehicle policies
- Identifies common approaches
- Documents best practices
- Identifies challenges and obstacles
- Provides airport resources for clean vehicle policy implementation

Published July 2018
Telephone interview with 11 airports and 13 ground transportation (GT) operators

Response rate:
- 80% - airports
- 50% - private fleets

Separate questionnaires for airports and GT fleets
Criteria for selecting airports:

- Geographic location
- Size
- Experience with alternative fuels
- Attainment status
- Availability of good contacts
Criteria for selecting private GT fleets:
- Experience with alternative fuels
- Match with surveyed airports

Types of GT operators represented:
- Taxicabs
- Limousines/black cars
- Shared van rides
- Hotel/parking shuttles
- Rental car shuttles
- Scheduled airport service
- Transportation network companies (TNC)
Airports may formally or informally encourage AFV use by private GT fleets:

- Encourage specific AFV technology, or
- Endorse all AFV technologies

**Vehicle Technologies That Airport Ground Transportation Providers Are Encouraged to Use**

- Fuel-Efficient Vehicles (45+ MPG): 1
- AFV-Emission-Comparable Vehicles: 2
- Renewable Natural Gas (RNG): 1
- Renewable Diesel (RD): 1
- Plug-in Hybrid (PHEV): 2
- Propane (LPG): 3
- Liquefied Natural Gas (LNG): 1
- Hybrid-Electric (HEV): 2
- Electric (EV): 5
- Compressed Natural Gas (CNG): 6
- Biodiesel (BD): 1

Number of Airports
Just over half of surveyed airports reported having a formal clean vehicle policy for GT providers

- Five policy types:
  - 1. Explicit requirement for AFV use
  - 2. Fuel emission standards
  - 3. Minimum vehicle fuel economy
  - 4. Incentive for using AFVs
  - 5. Penalties for not using AFVs

- Requirements to reduce “empty rides”
- Different policies may apply to different types of GT operators
Policies for Ground Transportation Operators

Taxicabs:
- AFV use requirement
- Requirement to use fuel-efficient vehicles
- Lower fees for use of clean vehicles

Limousines
- None

Shared Van Rides
- Explicit AFV requirement
- Minimum emission standard
- Lower airport fees for AFV use
Policies for Ground Transportation Operators

Hotel & Parking Shuttles/Rental Car Shuttles/Scheduled Airport Service
- Emission standards
- Lower airport fees for AFV use
- Higher fees for not using AFVs

TNCs
- Lower airport fees for using clean vehicles
- Higher fees for not using clean vehicles
- VMT reduction requirement

Airports are less likely to impose any restrictions on types of vehicles used by TNCs
Main reasons for implementing clean vehicle policies:

- Reduce airport GHG emissions
- Establish “green” image in the community
- Comply with government regulations/agreements
- Business opportunity (e.g. fuel sales)
- Contribute to carbon accreditation/certification

Approaches in developing clean vehicle policies:

- Involve private fleets – 60%
- Do not involve fleets – 40%
Barriers – Airport Clean Vehicle Programs

Major barriers for airport clean vehicle programs:
- Lack of financial resources/grants for AFVs
- Cost of AFVs
- State of alternative fuel technologies
- None – 25%

Other barriers:
- Lack of understanding and prioritization from private fleets
- Lack of public-use fueling infrastructure
- Difficulty with monitoring/enforcement
- Out of phase with concession negotiation timeline
- Challenges with providing fair treatment to all fleets
- Impact of TNCs on GT operators limits ability to impose additional regulations
Smaller pool of grant funding opportunities

Grants for private GT operators:
- None – 64%
- Unknown – 18%
- WV settlement – 9%
- Voucher program (CA) – 9%
- State grants – 9%

More state grants/rebates in the past

Most airports are unable to provide help to private GT operators with securing grants
Different types of GT fleets (13)

Different vehicle ownership models
- Owner operators - 3
- Company-owned - 7
- Hybrid ownership - 3

Larger fleets prefer owner-operator and hybrid ownership models
Use of AFVs and idle reduction policies are the most popular sustainability strategies.

Other practices:
- Fuel-efficient & newer models
- Deadhead trip reduction

Deadhead trip reduction strategies:
- Match drop-offs with pick-ups
- Use appropriate type and size of vehicles
Reasons for implementing sustainability practices:

- Reduce emissions/environmental impact
- Cost savings
- Airport requirement
- Create efficient experience for customers

Sustainability practices planned for the future:

- Continue/expand using AF technology
- May consider other AF technologies/vehicles if technical characteristics/costs/ROI improve
- Implement better vehicle/trip tracking system
- Implement AFV lease program
- None
Perception of private operators

Driver acceptance of clean vehicle policies:
- Unhappy with some aspects of the policy
- Initial resistance, but now embrace the policy

Compliance:
- Some difficulties in meeting the requirements of airport clean vehicle policies
- No difficulties
Main barriers for implementing sustainability projects:

- Higher upfront cost of AFVs
- Range and fueling time of AFVs
- Access to fueling infrastructure
- Lack of qualified/certified mechanics
- Low prices of gas
- Availability of AFVs
- Customer preference
- Regulatory issues regarding AFV conversions
Available Incentives:

- Federal/state/local tax credits to purchase AFVs
- Grants/rebates to purchase/convert AFVs
- None
- Not aware of incentives
- Lower airport trip fees

Most effective incentives:

- Preferential treatment of AFVs by airports
- Tax credits/rebates
- Longer airport agreements/exclusive airport access
- Direct grants to purchase/convert AFVs
Fleets’ Recommendations to Airports

- Ensure fleet access to fuel/provide fueling infrastructure
- Involve GT providers while developing clean vehicle policy
- Treat all operators equally
- Longer/exclusive contracts with GT providers using AFVs
- Ensure consistency between policy and local regulations
- Stimulate AFV usage rather than restrict traditional vehicle use
Transportation Network Companies

Airport Perspective

- TNCs are not subject to clean vehicle policies
- Reduced airport fees for AFV use, reduction of empty rides
- Penalty-based policy

Challenges:
- Regulation is under development
- Light state regulations
- Difficulty in tracking TNC operations

Fleet Perspective

- Traditional GT operators (e.g. taxis) experienced market share loss
- Private operator perspective on TNCs:
  - Issues with equity
  - Need diverse GT operators
  - Limit regulation
## Table G1 – AFV emissions comparison

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>GHG Emissions (Operations)</th>
<th>Criteria Air Pollutants (Operations)</th>
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<tbody>
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<td>CO₂ (kg/mi)</td>
<td>CH₄ (g/mi)</td>
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<td>Electricity (plug-in hybrid)</td>
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<td>Electricity (all-electric)</td>
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</table>

*Source: Adapted from Argonne National Laboratory’s GREET Model (ANL 2017)*

*The estimates presented in the table reflect the emissions associated only with vehicle operation.*
SAN FRANCISCO INTERNATIONAL AIRPORT (SFO)

SFO Clean Vehicle Fact Sheet

Clean Vehicle Policy
San Francisco International Airport adopted a Clean Vehicle Policy in February 2000. The policy strongly encourages the replacement of gasoline and diesel vehicles with clean air vehicles powered by alternative fuels like compressed natural gas (CNG) and electricity. In sectors where manufacturers have offered competitive alternative fuel vehicles and products, the policy’s goal of 100% clean air vehicles in Airport and Airport-permitted fleets has been met. Ground transportation sectors operating virtually 100% clean air vehicles include BART, AirTrain, on-Airport shuttle buses, hotel and off-Airport parking courtesy shuttles, shared-ride vans, and San Francisco city taxis.

The Airport uses financial and nonfinancial incentives to encourage alternative fuel use by fleet operators. In addition, hotel courtesy shuttle operators have reduced miles traveled by one third. The Airport hosts two of the largest public CNG fueling stations in Northern California.

Greening the Airfield SFO’s Clean Vehicle Policy extends to airfield vehicles. The move to electrify aircraft ground service equipment (GSE) started a generation ago. Now, some 650 pure electric vehicles are in service, representing about 40% of all tenant-operated airfield vehicles. Terminals 2 and 3E feature Airport-supplied electric GSE chargers serving all gates. SFO will provide airfield chargers at all terminals when they are rebuilt, or sooner.

AirTrain/BART
SFO operates AirTrain, an automated people mover linking the Airport’s terminals, short-term parking garages and Rental Car Center. AirTrain replaced the airport’s diesel-powered rental car shuttle buses, which operated 500 round trips per day. Powered by clean hydro-electricity, AirTrain eliminates all emissions for a service used by a quarter of Airport customers. BART, the near-zero-emission regional electric rail system, operates direct to the International Terminal. It carries 10% of air passengers and numerous employees. Almost 30% of air passengers traveling to and from the East Bay use BART.
FOR ADDITIONAL INFORMATION

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Clean Vehicles, Fuels and Practices for Airport Private Ground Transportation Providers – LAX Case Study

May 8, 2019
Tami McCrossen-Orr  
Los Angeles World Airports (LAWA)

✈ Chief Airport Planner II, Environmental Programs Group, Sustainability Section
✈ Manager of the Sustainability Program for LAX and Van Nuys general aviation airport
✈ Manager of LAWA’s Natural Resources and Wildlife section
✈ LAWA is currently updating its Sustainability Plan, with a big focus on improving air quality in and around LAWA’s airports
Commitment made to the surrounding community in the 2007 Community Benefits Agreement

- Targets reduction in nitrogen oxides (NOx) and particulate matter (PM) criteria air pollutants
- Applies to on-road medium & heavy-duty vehicles (>8,500 GVWR) used in operations at LAX
- Included in new and renewed LAX contracts, permits, leases, agreements, Non-Exclusive License Agreements (NELAs) and Certified Service Provider License Agreements (CSPLAs)

Revised in October 2017

- Update definition of compliant clean vehicles
- Added age requirement
- Enforcement provisions included
October 2017 Program Update

• **Vehicle requirements:**
  a. **Maximum Allowable Vehicle Age**
     Engine Year cannot be greater than 13 model years of the current reporting year;
     AND
  b. **Vehicle Type and Replacement**
     Vehicles must be alternative fuel (non-petroleum derived), electric, gasoline/diesel vehicles that are an optional low NOx vehicle or a CARB Low Emission Vehicle (LEV III)

• **Low-use exemption:** < 5 times/month

• **Explicit enforcement provisions:** for Non-Reporting and Vehicle Non-Compliance

  ❖ **Goal:** 100% Compliance in 2019
# Reporting Compliance

<table>
<thead>
<tr>
<th>Reporting Year</th>
<th>Total Operators</th>
<th>Total Operators Reporting</th>
<th>Total Operators Not Reporting</th>
<th>Percent Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>468</td>
<td>454</td>
<td>14</td>
<td>97%</td>
</tr>
<tr>
<td>2017</td>
<td>474</td>
<td>473</td>
<td>1</td>
<td>99%</td>
</tr>
<tr>
<td>2018 (preliminary)</td>
<td>432</td>
<td>352</td>
<td>80</td>
<td>81%</td>
</tr>
</tbody>
</table>

**Reporting Requirements**

- Annual reports due January 31\(^{st}\) for vehicles used at LAX the previous calendar year

- Reports are web-based, accessible to the operator using individualized pin, and simple to use
# Vehicle Compliance

<table>
<thead>
<tr>
<th>Reporting Year</th>
<th>Total Compliant Vehicles</th>
<th>Total Vehicles</th>
<th>Percent Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>707</td>
<td>1467</td>
<td>48%</td>
</tr>
<tr>
<td>2017</td>
<td>1368</td>
<td>1919</td>
<td>71%</td>
</tr>
<tr>
<td><strong>2018 (preliminary)</strong></td>
<td><strong>1356</strong></td>
<td><strong>1509</strong></td>
<td><strong>90%</strong></td>
</tr>
</tbody>
</table>

**Improved vehicle compliance due to:**
- LAX’s Zero & Near Zero Heavy Duty Incentive program accelerating the deployment of cleaner vehicles
- LAWA launched a web-based vehicle identification and incentive tool
- Operators’ commitment to transitioning fleets to cleaner vehicles
2017 Vehicle Compliance by Type of Use

Compliance % by Type of Use

- Catering: 29%
- FlyAway: 50%
- Delivery: 57%
- Scheduled Service: 57%
- Passenger Vans: 64%
- Maintenance: 73%
- Airlines: 75%
- Hotel/Motel Shuttle: 77%
- Long Distance Shared - Ride: 77%
- Shuttle: 93%
- Rent-A-Car Shuttle: 100%

Compliance %
2017 Non Compliant Vehicles by Fuel Type

Non-Compliant Vehicles by Fuel Type

- Diesel: 326
- FlexFuel: 21
- Gasoline: 196

Priority for Alternative Fuel Vehicle Incentive Program

Non Compliant Diesel Count by Type of Use

- Catering: 123
- Delivery: 121
- Maintenance: 28
- Flyaway: 21
- LAX Fleet: 10
- Schedule Service: 8
- Hotel/Motel: 5
- Passenger Vans: 5
- Shuttle: 4
- Long Distance Shared Ride: 1

Non Compliant Diesel Count
2018 Activities

• **Outreach to Operators**
  - One-on-one meetings
  - Workshop at ACT Expo

• **LAX Alternative Fuel Vehicle Incentive Program**
  - Provides funding to operators to cover the incremental cost to replace heavy-duty diesel vehicles with zero or near-zero emission vehicles
  - Program compatible with other incentive programs
  - 14 applications received for 25 vehicles

• **Web-based tool helps LAX operators transition to lower polluting vehicles**
  - Finds AFV compliant vehicles by multiple fuel types (including zero-emissions)
  - Identifies grants and incentives to offset vehicle cost
  - Online tool: [https://altfueltool.lawa.org](https://altfueltool.lawa.org)
Today’s Participants

- Abubaker Azam, *San Francisco International Airport*, abubaker.azam@flysfo.com
- Geoffrey Morrison, *The Cadmus Group, Inc.*, geoffrey.morrison@cadmusgroup.com
- Cian Fields, *The Cadmus Group, Inc.*, cian.fields@cadmusgroup.com
- Alexander Kolpakov, *Center for Urban Transportation Research, University of South Florida*, kolpakov@cutr.usf.edu
- Austin Sipiora, *Center for Urban Transportation Research, University of South Florida*, asipiora@cutr.usf.edu
- Tami McCrossen-Orr, *Los Angeles World Airports*, TMCROSSEN-ORR@lawa.org
Panelists Presentations


After the webinar, you will receive a follow-up email containing a link to the recording
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Report 11: *Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories*

Report 80: *Guidebook for Incorporating Sustainability into Traditional Airport Projects*

Report 83: *Assessing Opportunities for Alternative Fuel Distribution Programs*

Report 165: *Tracking Alternative Jet Fuel*

Synthesis 10: *Airport Sustainability Practices*

Synthesis 24: *Strategies and Financing Opportunities for Airport Environmental Programs*

Synthesis 54: *Electric Vehicle Charging Stations at Airport Parking Facilities*

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